

Adaptive Control Methods for Soft Robots

Completed Technology Project (2015 - 2016)



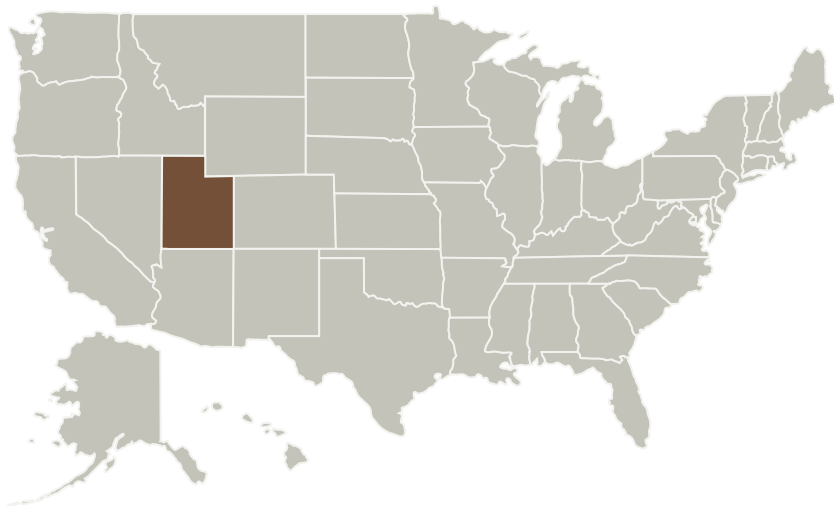
Project Introduction

I propose to develop methods for soft and inflatable robots that will allow the control system to adapt and change control parameters based on changing conditions either in or around the robot. Robots used in space exploration experience constantly changing conditions in the environment and internally due to wear and tear. In order for the robot to continue to perform properly the control system must adapt accordingly. I will implement adaptive methods using standard machine learning techniques together with Model Predictive Control (MPC). MPC will be used because it can produce stable, non-oscillating movement in systems where the robotic manipulator is underdamped (such as in soft robots). By implementing adaptive control into MPC the performance of the soft robot over time will be greatly enhanced. Much work has been done with adaptive control for typical robots but none has been done with soft or inflatable robots - an area or robotics in which NASA is currently investing due to size and weight benefits. Adaptive control of these soft robots will be critical if NASA hopes to use them on space missions.

Anticipated Benefits

Adaptive control of soft or inflatable robots will be critical if NASA hopes to use them on space missions.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Brigham Young University-Provo	Lead Organization	Academia	Provo, Utah

Primary U.S. Work Locations

Utah

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Brigham Young University-Provo

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Marc D Killpack

Co-Investigator:

Joshua P Wilson

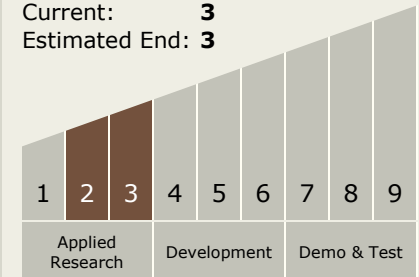
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Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX10 Autonomous Systems
 - └ TX10.2 Reasoning and Acting
 - └ TX10.2.4 Execution and Control

Target Destination

Mars